NOTICE OF AVAILABILITY
FINDING OF NO SIGNIFICANT IMPACT

U.S. ARMY AEROMEDICAL RESEARCH LABORATORY
ENVIRONMENTAL ASSESSMENT

1. PROPOSED ACTION: The proposed action (Alternative I, preferred alternative) and subject of this environmental assessment (EA) is the continuation of current and currently planned activities at the U.S. Army Aeromedical Research Laboratory (USAARL) located at Fort Rucker, Alabama. The USAARL is a subordinate laboratory of the U.S. Army Medical Research and Materiel Command (USAMRMC) which conducts research on health hazards associated with Army aviation, airborne operations, tactical vehicles, and selected weapons systems. This research is directed toward enhancing soldier protection and includes studies in acoustics, vision, impact, crew workload and stress, and life support technology.

2. ALTERNATIVES CONSIDERED: During the preparation of this EA, two alternatives in addition to the proposed action were identified. The alternatives included relocating USAARL activities to another location (Alternative II), and ceasing USAARL activities (Alternative III, no action).

3. ENVIRONMENTAL CONSEQUENCES AND MITIGATION MEASURES: It is unlikely that significant adverse environmental consequences will result from implementing the proposed action. The proposed action (Alternative I, preferred alternative) includes adherence to existing health, safety, and environmental regulations and standards that mitigate potential risks to human health and the environment.

4. FACTORS CONSIDERED IN THE FINDING OF NO SIGNIFICANT IMPACT: The EA systematically reviews the nature of the proposed action and associated risks and issues. Particular attention is given to protection of the workforce and surrounding community. Alternatives with regard to needs of the United States and the U.S. Army and potential adverse effects on the environment are evaluated.

5. CONCLUSIONS: The principal conclusion of this EA is that current and currently planned USAARL activities (Alternative I, the preferred alternative) are unlikely to result in significant adverse environmental impacts and are likely to result in important benefits to the U.S. by enhancing protection of the health, and safety of soldiers. Many existing USAARL facilities and on-site technologies are unique. Relocating USAARL to another location (Alternative II) will not likely alter the environmental impacts associated with conducting USAARL activities and will likely delay achieving USAARL mission requirements and increase associated costs. Ceasing USAARL activities (Alternative III- no action) will eliminate the minor to negligible environmental impacts associated with conducting USAARL activities, but will also eliminate the significant benefits resulting from USAARL research.

CLAUDIA BARTZ
Colonel, Army Nurse Corps
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Comments on this Finding of No Significant Impact may be directed to COMMANDER, USAMRMC, ATTN: MCMR-PA, CHARLES DASEY, FORT DETRICK, MD 21702 and must be received by July 14, 1998. Copies of the EA are available for review by the public at the Houston-Love Memorial Library, 312 East Burdeshaw, Dothan, AL 36302; Daleville Library, Daleville, Al 36322; Enterprise Public Library, 101 E. Grubbs Street, Enterprise, AL 36330; Ozark-Dale County Public Library, 320 James Street, Ozark, AL 36360; The Aviation Technical Library, Bldgs. #5906-5907, Fifth Avenue & Skychief Street, Fort Rucker, AL 36362; The Center Library, Bldg. #212, Novosel Street & Fifth Avenue, Fort Rucker, AL 36362, and at http://MRMC-www.army.mil

UNITED STATES ARMY AEROMEDICAL RESEARCH LABORATORY
ENVIRONMENTAL ASSESSMENT

JUNE 1998

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U.S. ARMY AEROMEDICAL RESEARCH LABORATORY

ENVIRONMENTAL ASSESSMENT

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Contract No. DAMD17-93-C-3141

June 1998

EXECUTIVE SUMMARY

The proposed action (Alternative I) of this Environmental Assessment (EA) is to continue the Army Operational Medicine research activities currently conducted at the U.S. Army Aeromedical Research Laboratory (USAARL) at Fort Rucker, Alabama. The research efforts at USAARL are directed toward protecting the well-being of soldiers through research on health hazards associated with Army aviation, airborne operations, tactical vehicles, and selected weapon systems.

Two alternatives to the proposed action have been identified: (1) relocate USAARL research activities to another location (Alternative II); and (2) cease USAARL research operations (Alternative III, No Action). The proposed action and alternatives considered were analyzed relative to the needs of national defense and the probable and possible environmental impacts of their implementation, including impacts to human health.

This EA was prepared in accordance with guidance provided in Army Regulation 200-2, *Environmental Effects of Army Actions*, dated December 23, 1988, implementing the *National Environmental Policy Act* (42 U.S. Code 4321-4347). This EA, *U.S. Army Aeromedical Research Environmental Assessment*, was researched and prepared by BSA Environmental Services, Inc. under subcontract to Science Applications International Corporation (SAIC), for the U.S. Army Medical Research and Materiel Command (USAMRMC) under Government Contract Number DAMD17-93-C-3141.

The principal conclusions of this EA are: (1) risks to the environment and human health and safety associated with the continued operation of USAARL in its present scope and location (Alternative I) are extremely small; (2) the research activities conducted at USAARL will result in important benefits to the United States by protecting United States military personnel; and 3) implementation of the proposed action (Alternative I) will not result in significant adverse environmental or human health impacts. Although implementation of Alternative II (Relocate USAARL Research Activities) or Alternative III (Cease USAARL Research Activities, No Action) is not likely to cause significant adverse environmental or human health impacts, neither alternative adequately addresses the needs of national defense.

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TABLES

1.0 PURPOSE AND NEED FOR THE PROPOSED ACTION

The proposed action and subject of this Environmental Assessment (EA) is the continued operation of the U.S. Army Aeromedical Research Laboratory (USAARL) at Fort Rucker, Alabama. In 1962, the U.S. Army Aeromedical Research Unit was established and was redesignated as USAARL in 1969. USAARL is a research laboratory under the U.S. Army Medical Research and Materiel Command (USAMRMC), a major subordinate activity of the U.S. Army Medical Command (MEDCOM). USAMRMC's mission is to protect the health and safety of military personnel, to develop medical materiel and procedures to treat injured personnel, and to hasten their return to duty. USAMRMC's research and development program is divided into four areas: Military Infectious Disease, Combat Casualty Care, Army Operational Medicine, and Medical Chemical/Biological Defense. These research programs are conducted at six subordinate research and development laboratories and institutes which assist USAMRMC in meeting their mission.

Research conducted at USAARL is a key component of USAMRMC's Army Operational Medicine Research Program the purpose of which is to identify, characterize, and provide physical and mental capabilities to help mitigate sources of battlefield stress. The mission of USAARL is to protect the wellbeing of soldiers through research on the health hazards associated with Army aviation, airborne operations, tactical vehicles, and selected weapon systems. Areas of research at USAARL include acoustics, vision, impact, crew work load and stress, and life support technology. In addition to USAARL, the U.S. Army Research Institute of Environmental Medicine (USARIEM) and the Walter Reed Army Institute of Research (WRAIR) conduct research in support of USAMRMC's Army Operational Medicine Program.

This EA describes the potential environmental impacts, including human health impacts, associated with implementation of the proposed action and two alternatives to the proposed action. This analysis considers impacts expected to result from the research activities conducted at USAARL in their present size and scope, including adverse environmental and human health impacts, cumulative impacts that might occur after several years, combined impacts resulting from other activities in the area, and impacts resulting from an accident or incident. As part of this analysis, this EA also characterizes the environment potentially affected by the proposed action.

Pursuant to NEPA (42 U.S. Code [USC] 4321-4347), each federal agency must give appropriate consideration to the potential environmental impacts associated with its proposed major actions. The Council on Environmental Quality (CEQ), Executive Office of the President has promulgated regulations implementing the National Environmental Policy Act (NEPA) (40 Code of Federal Regulations [CFR] Parts 1500-1508). Army Regulation (AR) 200-2, *Environmental Effects of Army Actions*, dated December 23, 1988 (32 CFR 651), is the Department of the Army's (DA) implementation of NEPA and CEQ regulations. This EA was prepared in accordance with AR 200-2 and CEQ regulations.

To reduce redundancy with previous relevant documents as required by the CEQ (40 CFR, Parts 1500-1508), this EA is tiered, in part, to earlier NEPA documentation including the *Environmental Assessment for the Proposed Establishment of a Battle Maneuver Area for Tracked Vehicles, Fort Rucker, Alabama* (U.S. Army Corps of Engineers (USACOE), 1994), the *Environmental Assessment for the Proposed Construction of an Ammunition Storage and Issue Facility, Fort Rucker, Alabama* (USACOE, 1995), and the *Environmental Assessment for the*

Proposed Construction and Operation of a Firefighter Training Facility, Fort Rucker, Alabama (USACOE, 1996).

2.0 DESCRIPTION OF THE PROPOSED ACTION

2.1 Introduction

The proposed action and subject of this EA is the continued operation of the USAARL at Fort Rucker, Alabama. The USAARL is one of six USAMRMC subordinate laboratories engaged in research to protect the health and safety of soldiers. USAARL's research activities are directed towards health hazards associated with Army aviation.

2.2 Location and Facilities

Fort Rucker is located in the southeastern corner of Alabama near the cities of Ozark, Enterprise, and Daleville (see Figure 2-1). USAARL is a tenant organization of the Fort Rucker Military Installation (see Figure 2-2). The Garrison Command at Fort Rucker provides services and support necessary for the daily operation of the Installation including police and fire services, engineering, housing, and contracting. Fort Rucker contains 1,199 buildings. USAARL occupies a total of 175,000 square feet in seven buildings; Buildings 6901 through 6906, and Building 8825 (Licina, 1998a) (see Figure 2-3). The majority of USAARL's research activities are conducted in Building 6901. Some of the special facilities used in USAARL research include an acoustic anechoic chamber (no echo), an EMIEMC (electromagnetic interference electromagnetic compatible) anechoic chamber, a reverberation chamber, a Multi-Axis Ride simulator (MARS), a freefall helmet drop tower, an American National Standards Institute (ANSI) helmet drop tower, a chinstrap tester, a JUH-1 research flight simulator, a JUH-60 research flight simulator, the JUH-60A aircraft, JUH-1H rotary wing aircraft, and 1H rotary wing and C-12 fixed wing aircraft.

The anechoic and reverberation chambers, located in Building 6901, are used for evaluating hearing protectors and communication devices. Research results are used to develop hearing protection and safety standards. The anechoic chamber - the largest human anechoic chamber in the free world - may be closed in the near future do to resourcing constraints (Licina, 1998b). Building 6901 also houses the freefall helmet drop tower, the ANSI helmet drop tower, the standard helmet drop tower, and the chinstrap tester which are used for impact and dynamic retention tests. The JUH-60 research flight simulator, also located in Building 6901, is equipped with an Environmental Control System (ECS) which is unique among simulators in the world (Licina, 1998b). The ECS simulates conditions in aircraft cockpits allowing researchers to study the effects of environmental extremes, sleep deprivation, and pharmacological interventions on the physical and mental performance of aviators.

The MARS is a unique, permanent facility located in Building 8825 that simulates the ride motion of Army aircraft or vehicles. Research conducted with this system is oriented toward spinal injury and back pain issues in helicopter pilots, determining injury levels from repeated shock and vibration, and defining maximum helmet weight and center of gravity limits for safety and best human operational performance.

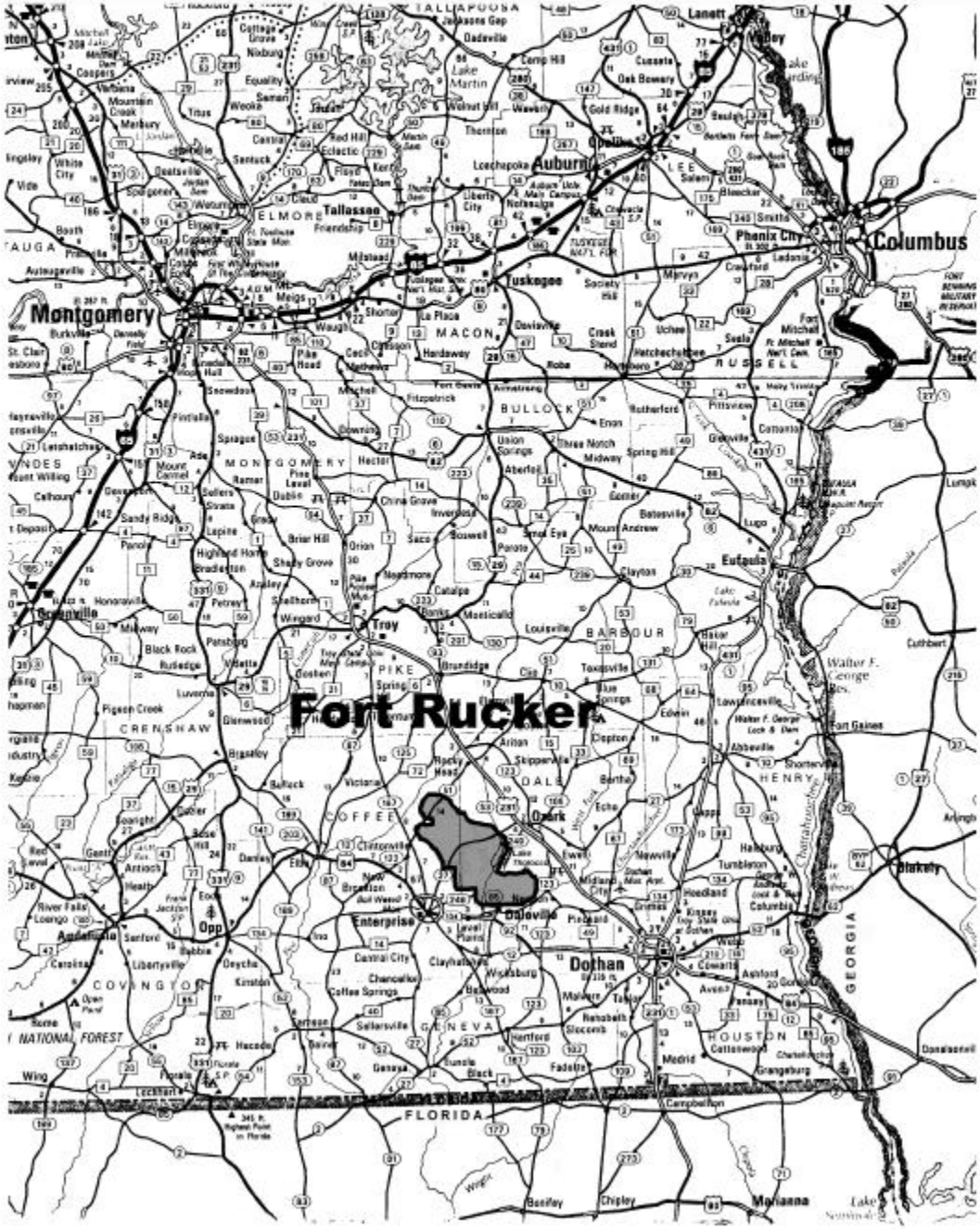

Figure 2-1. Location of Fort Rucker, Alabama

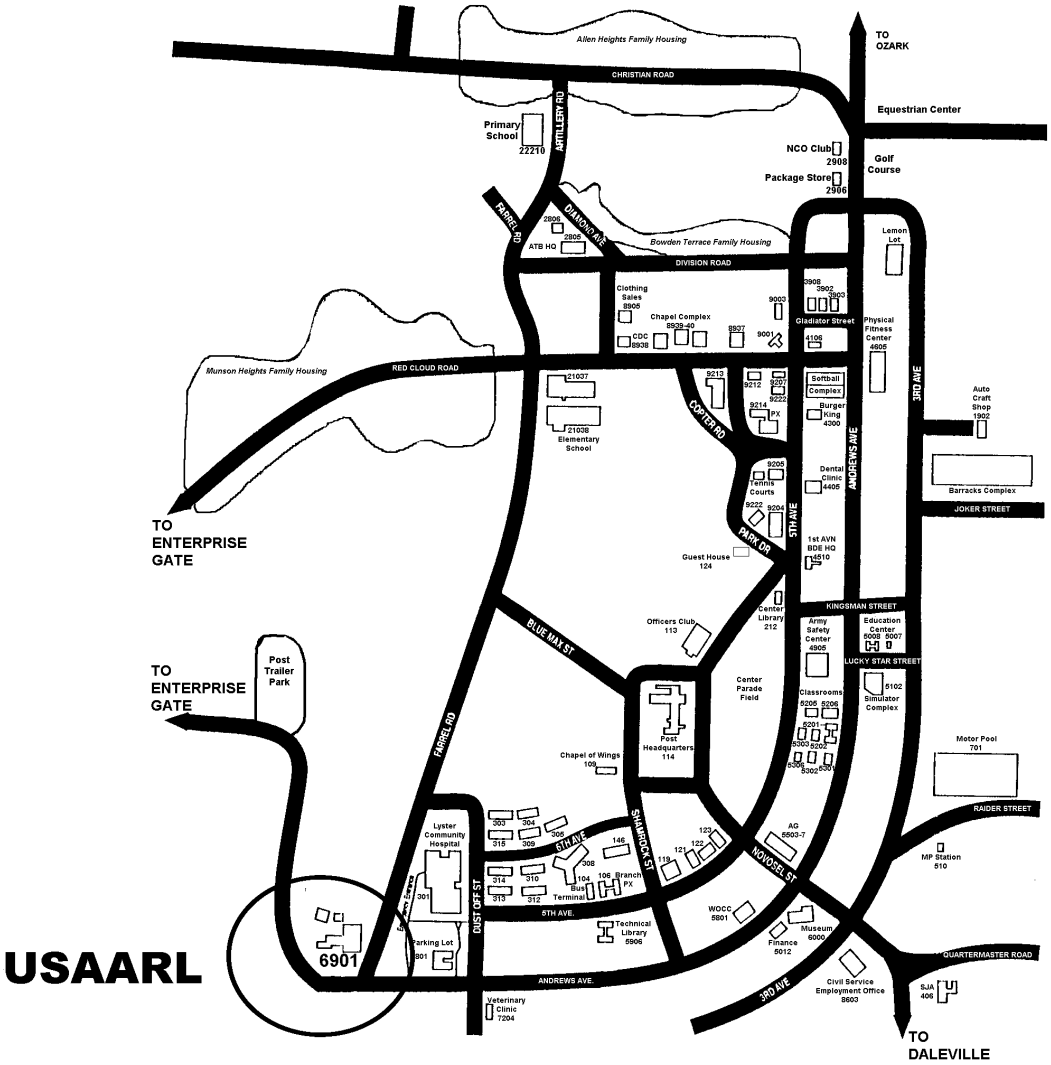

Figure 2-2. Location of USAARL on Fort Rucker

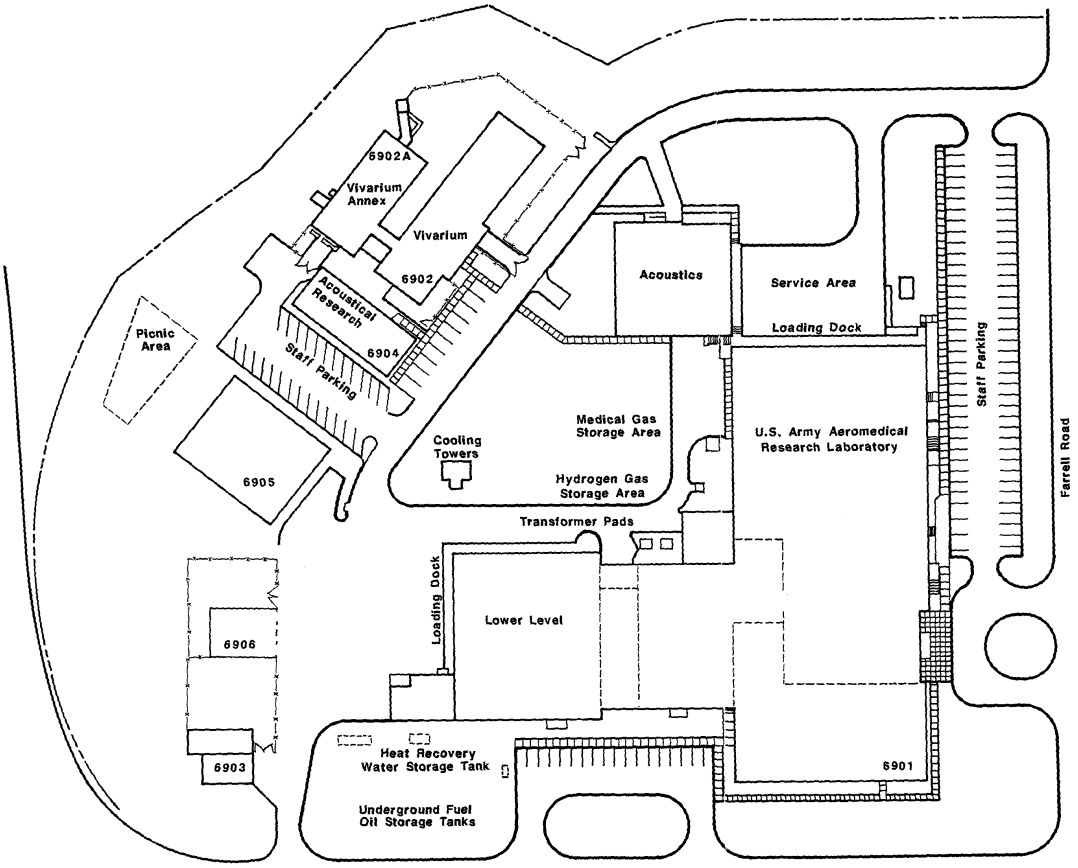

Figure 2-3. Schematic Diagram of USAARL

2.3 Mission and Organization of USAARL

The mission of USAARL is to conduct basic and applied research on the health hazards of Army aviation, airborne operations, selected weapons systems, and tactical combat vehicles to determine their effects on the safety, health, combat effectiveness, and survivability of aviators and soldiers. Health hazards that may affect military personnel include noise, impact, vibration, acceleration, visual demands, stress, and fatigue. The objectives of USAARL's research efforts are to prevent or minimize health hazards and to enhance soldier performance. USAARL conducts research in the areas of vision, acoustics, crew work load and stress, impact, and life support technology (USAARL, undated(a)). Although the mission of USAARL is directed towards the unique occupational problems of Army aviation, research advances are applied throughout the military (Dothan Progress, 1997).

In addition to Army Operational Medicine research activities, USAARL provides research assistance to other USAMRMC institutes and laboratories engaged in the study of medical defense against chemical agents, bioeffects of laser systems, impacts of continuous operations on performance, and developing improved methods for patient evacuation. Results of research conducted at USAARL are also used to assist developers of Army vehicle systems in identifying and eliminating health hazards during early stages of development of the systems.

USAARL is composed of two research divisions and one support division. The two research divisions are the Aircrew Protection Division and the Aircrew Health and Performance Division. The Research Support Division provides technical support to USAARL. Administrative support is provided by Headquarters, USAARL USAMRMC.

2.4 Research Areas and Operations

The following sections describe the current focus of USAARL research.

2.4.1 Aviation Visual Systems Research

Aviation Visual Systems Research includes the study of electro-optical devices, image

intensification devices, crewstation displays and lighting, contact lenses in military environments, corrective/protective eyewear, and visual standards. One objective of this research is to optimize the safety and performance of aviators in flight (USAARL, undated (a)).

USAARL researches ways to optimize the use of imaging systems. These imaging systems broaden aviator performance through the use of principles such as image intensification and infrared radiation detection which extend human vision and enhance aviator piloting and target detection capabilities. Research involves extensive physical and psychophysical evaluations to ensure optimum performance of aviators when using imaging system displays. Image intensification devices such as the Aviator's Night Vision Imaging System (ANVIS) increase the aviator's vision in the dark by amplifying available light. USAARL also investigates the effects of light sources inside the cockpit (i.e., flight instrument display and auxiliary lighting devices) on ANVIS performance and conducts studies to determine the compatibility between vision devices and light systems found on aircraft (USAARL, undated (b)).

USAARL investigators develop new methods for assessing vision and conduct research on corrective eyewear (e.g., soft contact lenses, bifocal contact lenses) for pilots. Research in this area utilizes the laboratory, the research flight simulator, and operational aircraft. Computer

technology is used to develop new methods for assessing vision. Luminance and color light stimuli are used to test static and dynamic properties of vision. USAARL developed the Small Letter Contrast Test (SLCT), a more sensitive test method to detect subtle changes in vision (USAARL, undated (b)).

USAARL investigators have conducted research on different types of reflective materials to assist in making power lines more identifiable to aviators. USAARL has filed a patent application for a solar-powered wire marker with a flashing light (USAARL, undated (b)).

2.4.2 Aircrew Hearing Protection and Communications Research

During combat, soldiers may be exposed to acoustic hazards which may result in noise-induced hearing loss. In addition, soldiers may be exposed to blast overpressure effects from weapon systems. Aircrew hearing protection and communications research focuses on the evaluation of communication devices and hearing protectors. Results of the research conducted at USAARL are used to develop hearing protection and safety standards. Investigators involved in aircrew hearing protection and communications research utilize the anechoic chamber and reverberation chambers. USAARL contributes to the development of hearing protection systems through research efforts which include prevention and treatment strategies for noise-induced hearing loss, test methods for early detection of hearing loss, and developing techniques and methods to enhance speech intelligibility in noisy environments. Soldiers can be protected from blast overpressure by adjusting the rate and intensity of weapon firing while maintaining maximum weapon effects. Results of this research can be applied to non-military situations such as police assault forces, construction and mining industries, and explosives (USAARL undated (b)).

2.4.3 Aviator Flight Performance Research

Aviator flight performance research involves studies aimed at preventing spinal injury and back pain in helicopter pilots, studying shocks and vibration to determine injury levels, and evaluating helmets to determine the maximum head-supported weight and center of gravity for optimum safety and performance. Investigators also evaluate workload and fatigue through studies involving aviator work/rest schedules and sleep discipline, sustained aviator performance, pharmacological countermeasures, and aviator performance with night vision systems. USAARL also assists in analyzing medical standards used by the Army to select and retain healthy career aviators (USAARL, undated (b)).

Aviator flight performance research is conducted using a UH-60 Black Hawk flight simulator with an environmentally controlled cockpit, the JUH-60 and JUH-1 aircraft equipped with flight data recording systems, an instrument simulator, MARS, and a state-of-the-art sleep laboratory equipped with two brain mapping systems. The MARS simulates the motion of Army aircraft and tactical vehicles. Research involving the measurement of biomedical effects and performance of human volunteers exposed to ride motion forces has led to development of a jolt exposure safety standard while optimizing crew performance (USAARL, undated (a)). The sleep laboratory, research flight simulator, and specially instrumented aircraft are used to study workload and fatigue. Research in this area includes the use of melatonin (a hormone produced by the pineal gland) which resets the body's clock (USAARL, undated (b)). Since 1990, USAARL has provided aviators with strategies to prevent sleep loss and performance degradation during night operations and travel across time zones.

2.4.4 Helmet Impact and Retention Testing

Helmet impact and retention testing is conducted by personnel with medical and engineering expertise in crash injury prevention. Impact and dynamic retention tests are performed using a standard helmet drop tower, a freefall helmet drop tower, a swing tower, a dynamic chinstrap tester, an automated tester for helmet mass properties, and a laser head scanner.

2.4.5 Helicopter Crash Injury Research

Helicopter crash injury research is directed towards understanding human injuries and damage to personal protective equipment (e.g., crashworthy seating, flight helmets, and restraint systems) resulting from a crash. USAARL contributes to aircraft safety by analyzing and correcting design and operational deficiencies in personal protection devices. Computer simulation of crashes, static and dynamic testing of systems and devices, and manikins and human volunteers are used to develop crash protection standards and design criteria for future systems. Research results are used to recommend product improvements to developers of Army aircraft systems and personal protection devices.

2.4.6 Aeromedical Evacuation Equipment Testing

Aeromedical evacuation equipment testing determines the clinical performance of medical devices operating in the harsh Army Medical Evacuation (MEDEVAC) aviation environments and each device's potential for electromagnetic interference in an aircraft. Research in this area utilizes the JUH-60A aircraft and laboratory environmental, altitude, electromagnetic interference, and vibration facilities (USAARL, undated (a)).

2.4.7 Aviation Life Support Equipment Retrieval Program

The objective of the Aviation Life Support Equipment Retrieval Program (ALSERP) (USAARL Policy No. 95-55) is to maintain and increase the level of protection provided to aircrew during aircraft mishaps (USAARL,1997b). This effort is based upon empirical data obtained from military aviation mishaps worldwide. Researchers analyze injuries and the performance of Aviation Life Support Equipment (ALSE) following aviation mishaps to determine why impact injuries occurred or did not occur, and to develop concepts and criteria for design improvements for ALSE.

The Aviation Life Support System (ALSS) consists of components, techniques, and training to ensure that aircrew and passengers have the best possible flight environment. The ALSS is composed of three subsystems: the Environmental Life Support Subsystem, the Escape and Descent Life Support Subsystem, and the Life Support Survival Recovery Subsystem. The Environmental Life Support Subsystem provides support protection and comfort to crewmembers and passengers in normal flight environments. Aircrew station and personal supplies include oxygen equipment, flight and specialized clothing, and aircrew support facilities. The Escape and Descent Life Support Subsystem components include harnesses, ejection crashworthy seats, parachutes, propellant devices, and let down ropes and equipment to ensure safe and reliable escape and descent from disabled aircraft. The Life Support Survival Recovery Subsystem aids survival, evasion, escape, and recovery of downed aircrews and passengers in various environments. Components of this subsystem include life preservers and rafts, aircrew chemical, biological, and environmental clothing, anti-exposure suits, survival vests and kits, and signaling devices. The Aviation Life Support Officer (ALSO) assists the Commander in matters regarding

the ALSS, including reviewing and developing procedures for planning and maintaining an ALSS. Training is provided for the proper operation, maintenance, and use of survival equipment and techniques (USAARL, 1997c).

The U.S. Army Safety Center electronically notifies the USAARL ALSERP managers of all aviation accidents and incidents. An ALSERP representative will accompany the USASC Centralized Accident Investigation (CAI) team on selected Classes A and B flight mishaps. In accordance with DA Pam 385-40, *Army Accident Investigation and Reporting*, USAARL receives all aviation life support and personal equipment retrieved from aviation mishaps that may be implicated in the cause or prevention of injuries. Equipment received by USAARL is documented on DA Form 2397-10R, *Technical Report of U.S. Army Aircraft Accident, Personal Protective/Escape/Survival/Rescue Data*. All information related to the mishap must be maintained, safeguarded and stored in a locked area at all times. Data in the case files are transferred to the ALSERP database when evaluation is complete. The database may only be accessed by ALSERP team members (USAARL, 1997b). Following evaluation, unserviceable items (i.e., biologically or chemically contaminated) are disposed of in accordance with AR 200-1 and USAARL's Hazardous Waste Policy, and serviceable items are returned to the owner.

2.5 General Safety

USAARL Policy No. 385-10, *General Safety*, establishes the USAARL Safety Program, describes procedures for implementing the program, and assigns responsibilities (USAARL, 1997d). There are two safety officers at USAARL; the USAARL Safety Manager advises and represents the Commander on safety issues pertaining to ground operations, and implements the safety program; and the Aviation Safety Officer (ASO) whose duties and responsibilities are detailed in AR 385-95, *Army Aviation Accident Prevention.*

2.5.1 Ground Safety

USAARL Policy No. 385-10 establishes general safety procedures including the use of personal protective clothing and equipment, maintenance of floor surfaces and passageways, and maintaining means of egress. Other areas covered under this policy include the use of power machinery and equipment, electrical safety, barrack safety, and the handling of flammable liquids. Safety reviews are conducted monthly by internal and/or external agency inspections (Licina, 1998a).

MARS is operated in accordance with USAARL Policy No. 385-11, *Multi-Axis Ride Simulator Operation with Human Subjects* (USAARL, 1997a).

2.5.2 Aviation Safety

The USAARL aviation safety program is detailed in USAARL Policy No. 385-95. The ASO serves as the safety representative and technical authority on all safety issues pertaining to aviation.

USAARL Policy No. 95-1, *Aviation Standard Operating Procedures*, supplements Army regulations, manuals, and circulars in directing aviation operations and research. This Policy contains Standard Operating Procedures (SOPs) for the safe operation of USAARL test equipment. USAARL Policy No. 95-1 establishes an Aircrew Training Program (ATP) to ensure that safety training is provided to USAARL crewmembers (USAARL,1997c). The

Standardization Officer is responsible for crewmember training and administration of the ATP. Newly assigned crewmembers must undergo local area orientation in accordance with Training Circular (TC) 1-210, *ATP Commander Guide*. This orientation covers four areas including aircrew information reading files, airfield layout and facilities, airfield operations and procedures, and local area orientation flight.

Regulations, directives, aviation safety data, and local operating procedures and environmental conditions are reviewed by the ASO to ensure compliance (USAARL, 1997e). The ASO must organize, conduct, and document monthly aviation safety meetings for all aviators and noncrew members, perform semiannual safety surveys, and ensure that emergency plans of action are comprehensive and functional in case of a mishap during flight testing. The laboratory Occupational Health and Safety Manager must provide four safety orientations to all laboratory personnel prior to every holiday weekend. Newly assigned personnel are required to attend a safety briefing presented by the ASO covering laboratory, flight line, and motor vehicle safety and general off-duty activities.

Research protocols involving flight must be evaluated by the ASO and Flight Systems Branch. All flight protocols must include a memorandum containing a hazard analysis and risk assessment. Flights which fall into the "medium" risk range must be approved by the USAARL Commander. "High" and "extremely high" risk category flights must be reviewed by USAMRMC. Flights required for research are further reviewed by the Aviation Branch Safety Officer and the U.S. Army Aviation Center (USAAVNC).

2.5.3 Radiation Safety

USAARL Policy No. 70-4, *Radiation Safety*, establishes the policies and procedures for minimizing exposure to radiation, and for the safe use and storage of radioactive materials and radiation producing sources, microwave and radio frequency radiation, and laser radiation (USAARL, 1997f). This policy encompasses NRC and DA regulations and directives. USAARL maintains a U.S. Nuclear Regulatory Commission (NRC) permit (NRC License Number 01-12632-02) for the use of specified radionuclides for research purposes (NRC, 1997a). The only radioisotope currently used in USAARL research activities is Iodine 125 (^{125}I) (Bleser, 1998). NRC conducted an unannounced radiation safety inspection in August 1997 and determined that USAARL was in compliance with NRC rules and regulations and the conditions of their permit (NRC, 1997b).

The Radiation Control Committee (RCC) is responsible for executing the Radiation Safety Program. The RCC maintains NRC licensing, prescribes standards of radiation safety, approves use and storage of radioactive materials and radiation sources, and studies reports of incidents and adverse findings. The RCC also reviews proposals to use or acquire radioactive materials such as SOPs and applications for licensing.

Acquisition, use, and transportation of radioactive materials and radiation sources must be approved by the RCC in writing. Research involving radioisotopes and radiation producing devices may be conducted in only one USAARL laboratory (L21-B) (Bleser, 1998). This area is designated as a controlled area and has limited access. All radioactive materials must be labeled with the radiation caution symbol, isotope identification, activity, and date measured. Radioactive materials must be stored in locked areas to prevent access by unauthorized personnel. Radioactive materials and radiation producing devices must be inventoried at least every 6 months, and all

work areas must be surveyed with a scan meter following the use of radioisotopes. A spill kit must be available in the laboratory for spills involving radioisotopes, and all spills must be immediately reported to the Radiation Protection Officer (RPO).

The RPO instructs personnel in safe working practices, emergency procedures, and the effects of overexposure to radiation, and records of this training must be maintained. Periodic observations of employees conducting work involving radiation must be performed to ensure compliance with established SOPs. Personnel handling radioactive materials must wear dosimetry badges at all times.

The RPO must conduct periodic inspections of laser radiation, and microwave and radio frequency radiation facilities. These Radiation Protection Surveys are conducted upon request or at the discretion of the RPO. USAARL's x-ray facilities have been closed and the x-ray machine and source have been turned in through the DRMO (Licina, 1998b). Personnel working in laser radiation, and microwave and radio frequency radiation facilities must undergo ophthalmologic examinations prior to and upon termination of employment. All personnel exposed to laser radiation must undergo eye examinations on an annual basis, or immediately following a potential exposure to laser radiation. Personnel exposed to microwave or radio frequency radiation must undergo semi-annual eye examinations. In addition, eye examinations are required immediately following a potential exposure to microwave or radio frequency radiation (USAARL, 1997f).

2.6 Security

USAARL's Physical Security SOP dated November 13, 1997 establishes guidelines and procedures for key control, crime prevention, and physical security (USAARL, 1997g). Entry into USAARL buildings is limited to personnel possessing an identification (ID) badge. Visitors must obtain a visitor's badge. Identification badges must be worn at all times within USAARL buildings, and must be removed when departing. Upon reassignment/transfer or termination, identification badges must be turned in.

Entry and exit of USAARL buildings after hours, on weekends, and holidays must be through the main doors. All personnel must sign in/out upon entering and exiting. Personnel with keys to outlying buildings must contact designated personnel upon entry/exit, and are responsible for securing the doors to the buildings. The Key Custodian signs keys in and out using DA Form 5513-R, *Key Control Register and Inventory*, and is responsible for maintaining key inventories. A key inventory must be conducted semi-annually and the key control registry inspected monthly. When research requiring additional security is conducted, activation of security cameras is required (Licina, 1998b). New personnel must be briefed on crime prevention, including security, registration of personal property, and sexual assault awareness. The crime prevention officer conducts quarterly crime prevention classes and monthly crime prevention/physical security inspections (USAARL, 1997g).

2.7 Emergency Procedures

The USAARL Emergency Notification Plan (USAARL Policy No. 500-1) and Fire Plan (USAARL Policy No. 420-90A) contain information for notification and response to emergency situations (e.g., severe weather, National Defense, fire) (USAARL, 1997h; USAARL, 1997i). Fort Rucker's Directorate of Public Safety provides Military Police and fire protection support to the Installation. Military Police patrol the Installation, control traffic, investigate accidents, and

support a Crime Prevention Program. The Fire Protection and Prevention Division provides services to Fort Rucker when requested. These services include fire protection and prevention, hazardous material accidents, crash and rescue operations, heavy extrication missions, high-rise structure maneuvers, high-angle and confined-space rescues, and advanced life support paramedic operations. USAARL's *Bomb Threat Standard Operating Procedure* provides guidelines for procedures if a bomb or explosive device is found or a bomb threat is received (U.S. Army Aeromedical Research Center, 1997).

2.8 Pollution Prevention

Pollution prevention measures in place at USAARL include the substitution of non-hazardous or less hazardous for hazardous materials. A chemical inventory control program for all tenants on the Installation has been initiated to facilitate sharing of excess chemicals between tenants. Ideally, this program will result in reduced consumption of hazardous materials and incorporate shelf-life management techniques to prevent excess serviceable materials from expiring. These pollution prevention measures should result in the decreased hazardous waste generation.

2.9 Waste Stream Management

USAARL generates wastewater and regulated medical waste, potentially infectious waste, hazardous waste, and radiological waste.

2.9.1 Wastewater

Wastewater generated at USAARL requires no special pretreatment prior to discharge into the sanitary sewer system. All wastewater is treated at the Fort Rucker Main Sewage Treatment Plant (Licina, 1998a). The Alabama Department of Environmental Management (ADEM) allows the sewage treatment plant to discharge to Claybank Creek under National Pollutant Discharge Elimination System (NPDES) Permit No. AL0002178. NPDES permit restrictions for the effluent from the Main Sewage Treatment Plant are provided in Table 2-1. The permit requires that USAARL conduct "more frequently than monthly" self-monitoring (ADME, 1993).

Table 2-1. Fort Rucker NPDES Permit No. AL0002178 Effluent Limitations*

Effluent Characteristics	Daily Minimum	Daily Maximum	Monthly Average
Flow	N/A	Monitor	Monitor
pH	6.0 s.u.	9.0 s.u.	N/A
Total Suspended Solids	N/A	45 mg/l	30 mg/l
Total Residual Chlorine	N/A	0.118 mg/l	0.068 mg/l
Fecal Coliform	N/A	2000/100 ml	1000/ml
December - April			
BOD_5	N/A	45 mg/l	30 mg/l
Ammonia as Nitrogen	N/A	40 mg/l	20 mg/l
Dissolved Oxygen	2.0 mg/l	N/A	N/A
May - November			
BOD_5	N/A	30 mg/l	15 mg/l
Ammonia as Nitrogen	N/A	10 mg/l	5 mg/l
Dissolved Oxygen	6.0 mg/l	N/A	N/A

*Source: ADEM, 1993

2.9.2 Medical Waste

All regulated medical waste generated by USAARL research activities must be stored in a freezer until disposal. USAARL previously operated a medical waste incinerator (Model No. CFA-3250) in accordance with an Alabama Department of Environmental Management (ADEM) permit. The incinerator was used infrequently and has not been operated since July 1997 (Licina, 1998b). USAARL is permitted to burn Types 0-4 wastes which include general solid waste and human and animal remains (ADEM, 1997). The incinerator is located adjacent to Building 6902 and was in operation from 1989 to July 1997. USAARL burned about 320 pounds of waste per year for the last 2 years including regulated medical waste and computer software (Licina, 1998a). Ash from the incinerator was tested annually for metals and the results were submitted to ADEM. Results of the 1997 ash analysis are presented in Table 2-2. Ash from the incinerator was disposed of in the Coffee County Landfill.

Table 2-2. Results of the 1997 Ash Analysis*

Contaminant	Maximum	Results (ppm)
Arsenic	5.0	<0.50
Barium	100.00	<1.00
Cadmium	1.0	0.55
Chromium	5.0	<0.50
Lead	5.0	2.81
Mercury	0.2	<0.10
Selenium	1.0	0.13
Silver	5.0	0.56

*Source: TTL, Inc., 1997

To comply with new USEPA regulations regarding medical waste incinerators, USAARL must have a plan of action by March 2000 to install an Air Pollution Control Device on its incinerator if it will be used again. Alternatives include retaining a contractor to dispose of medical wastes or use on-site disinfection technologies (Bradley, 1997).

2.9.3 Hazardous Waste

Hazardous wastes generated at USAARL between October 11, 1995 and January 12, 1998 are detailed in Table 2-3.

The USAARL Hazardous Waste Policy (No. 70-1) implements the Clean Air Act (CAA), the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), the Toxic Substance Control Act (TSCA) of 1976, and the Resource Conservation and Recovery Act (RCRA) of 1976 (USAARL, 1997j). This policy describes the procedures for handling hazardous and toxic materials to minimize hazards to health and the environment during research and development, production, testing, use, storage, and disposal. This policy directs use of nonhazardous and nontoxic materials whenever practicable. Proper warning signs and labels, safety materials and protective clothing, and equipment for emergency cleanup, treatment, and decontamination must be available (USAARL, 1997j).

Table 2-3. Hazardous Waste Disposal Log*

Date	Type of Waste	Quantity
October 11, 1995	Fluorescent light bulbs	9 boxes (135 pounds)
October 15, 1995	Hydraulic fluid	1 gallon
October-November 1995	Formalin	5 gallons
November 15, 1995	Pico eluent 1	45 bottles (950 ml each)
November 15, 1995	Pico eluent 2	9 bottles (950 ml each)
March 5, 1996	Lithium batteries	1 box (7 pounds)
August 22, 1996	Lead batteries sulfuric acid	1 box (4 pounds)
August 22, 1996	Lithium batteries	1 box (21 pounds)
August 22, 1996	Magnesium batteries	1 box (3 pounds)
August 22, 1996	Mercury batteries	1 box (6 pounds)
August 22, 1996	Nickel cadmium batteries	1 box (15 pounds)
August 22, 1996	Toner	1 box (21 pounds)
August 22, 1996	Waste petroleum distillates	1 box
January 27, 1997	1319 condensate treatment	5 gallons
January 27, 1997	Descaler	15 gallons
January 27, 1997	Sodium hydroxide	5 gallons
January 28, 1997	Ethyl ether	3 cans (6 pounds)
January 28, 1997	Phenol solid	10 bottles (16 pounds)
January 28, 1997	Phenol solution	3 bottles (6 pounds)
January 28, 1997	Potassium cyanide	2 bottles (5 pounds)
January 28, 1997	Sodium cyanide	1 bottle (3 pounds)
August 25, 1997	Promace	1 bottle (50 ml)
December 2, 1997	Fluorescent lamps	1 box (135 pounds)
December 2, 1997	Lead acid battery	1 box (20 pounds)
December 2, 1997	Nickel cadmium batteries	1 box (65 pounds)
January 9, 1998	10% formalin solution	1 gallon
January 12, 1998	Lead acid battery	1 box (8 pounds)
January 12, 1998	Lithium battery	1 box (2 pounds)
January 12, 1998	Nickel cadmium	1 box (16 pounds)

*Source: Bleser, 1997

2.9.4 Radioactive Waste

The USAARL SOP for Disposal of ^{125}I describes the policies and procedures for disposing of ^{125}I and ^{125}I-contaminated laboratory waste(USAARL, 1997K). According to this SOP, a radioisotope usage log must be maintained in the laboratory area to record estimated amounts of ^{125}I used for assays. Excess ^{125}I is emptied into the sanitary sewer. In accordance with NRC regulations (10 CFR 20.2003), liquid wastes containing radioisotopes below a specified radioactivity level and in a nonbiological and nonhazardous aqueous solution (e.g., water) may be disposed of into the sanitary sewer system. USAARL is permitted to release 164 microcuries (μCi) of ^{125}I into the sewer system per day in accordance with NRC and ADEM guidance (Mack, 1998). An estimate of the number of microcuries being disposed of must be recorded, dated and initialed on a radioisotope usage log. A summary of the monthly quantities of ^{125}I released into the sanitary sewer during 1997 is presented in Table 2-4.

Table 2-4. 1997 Monthly Disposal of Iodine 125 into the Sanitary Sewer System*

Month	Quantity (mCi)
January	14.00
February	9.660
March	42.83
April	38.25
May	20.00
June	40.00
July	16.625
August	15.00
September	1.00
October	0.00
November	0.00
December	2.00
AVERAGE	16.61 μCi/month

*Source: Mack, 1998

Laboratory materials (e.g., test tube, pipet tips) contaminated with ^{125}I must be placed in labeled plastic bags and monitored daily for fluid and radioactivity leaks. Plastic bags containing radioactive waste are labeled with the sequential bag number, the date opened, the date closed, and the date the bag is put into storage for natural decay (USAARL, 1997k). Information

maintained about waste bags placed into storage includes date, time, bag number, and a descriptive note. The RPO determines when waste bags are transferred to leak proof containers for storage. Storage containers are numbered sequentially and marked as "Class A waste". Once storage containers are three-quarters full, they are checked for leaks, sealed, and the date of placement of the last items in the container is marked on the lid. This date is used to calculate the release date which is estimated at 2.3 years for decay-in-storage based on ten ^{125}I half-lives (60.1 days). Contaminated waste must be stored for ten ^{125}I half-lives before it may be released for disposal as general waste. After the waste has been stored for the period of time necessary for natural decay, radioactivity labels are removed and the containers are disposed of as general trash. All ^{125}I waste disposal and storage logs must be maintained, and the RPO or a designated representative approves and periodically inspects all forms and log books used for tracking and documenting the disposal of ^{125}I waste (USAARL, 1997k).

2.10 Quality Assurance

USAARL Policy No. 40-66, *Quality Assurance*, establishes the policies and procedures for maintaining USAARL's Quality Assurance (QA) Program. Regulations that apply to quality assurance at USAARL include AR 40-61, USAARL Policy No. 65-2, and USAARL Policy No. 40-66. The QA Program for USAARL monitors and evaluates the quality of research and development, assures compliance with regulatory guidance, pursues opportunities for improved performance, and resolves problems. Two committees are involved in carrying out the responsibilities of the QA program, the QA Committee and the Credentialing Committee (USAARL, 1997l).

The QA Committee reviews guidelines and recommendations, develops and executes the USAARL QA Program, ensures research is conducted in accordance with applicable regulations, and that research personnel are properly credentialed. The QA Committee is required to review the QA Program at least annually and make revisions as needed. Representatives from the Scientific Review Committee, Human Use Committee, Animal Use Committee, Credentialing Committee, Chemical Surety Program, Controlled Substances Custodian, Radiation Safety Committee, and other groups contribute to QA assessment and monitoring.

The Credentialing Committee includes a chairperson and at least three other members. The Credentialing Committee reviews credentials and research privileges of personnel conducting investigations, studies, and tests or serving as Scientific Program Advisor, Deputy Commander for Science, or Medical Monitor, to ensure that only qualified individuals execute research procedures at USAARL. There are four categories of basic research credentials: Principal Investigator (PI), Associate Investigator (AI), Research Technician (RT), and Medical Monitor (MM). These credentials are further qualified by privileges in specific areas including human research, animal research, test and evaluation, and human research involving investigational products (USAARL, 1997l).

2.11 Human Volunteers

Human volunteers are used in the research program at USAARL. All volunteer studies must be conducted under the terms of USAMRMC Regulation 70-25, *Use of Human Subjects in Research, Development, Testing and Evaluation*. All research involving the use of human subjects must be documented by a scientific review process and presented before a Human Use Committee (HUC). The HUC must be composed of at least five members with varying backgrounds

(USAMRMC, 1989). USAARL's HUC must consist of at least one flight surgeon, one psychologist, one deputy commander, and one safety representative (Licina, 1998b). The HUC reviews, evaluates, and approves/disapproves proposed protocols. Protocols approved by the HUC are evaluated by the USAARL Laboratory Commander to determine if the study poses a minimal risk to human subjects. Protocols involving a minimal risk are reviewed and evaluated by the Human Use Review and Regulatory Affairs Office (HURRAO) at USAMRMC for approval/disapproval. Protocols determined to involve more than a minimal risk to human volunteers are reviewed and approved/disapproved by the HURRAO, the Human Subjects Research Review Board (HSRRB), and The Surgeon General (TSG).

Research protocols must be evaluated to determine if they meet the following requirements: anticipated benefits of the research justify the risks to human subjects, risks to human volunteers are minimized, informed consent is sought from each subject or the subject's legal representative, data are monitored to ensure the safety of subjects, the privacy of subjects is protected and confidentiality is maintained, and that additional safeguards are included to protect the rights and welfare of subjects with severe physical or mental illnesses or economically or educationally disadvantaged subjects (USAMRMC, 1990).

All human subjects must be volunteers who are fully informed of the research procedures and their associated risks. Informed consent is documented through the use of DA Form 5303-R. Medical monitors are responsible for the medical care of subjects involved in research. Research subjects may withdraw consent at any time. The PI responsible for the study may terminate research at any time if there is reason to believe that continuation of the study may result in serious injury, disability or death to the subject (USAMRMC, 1990).

2.12 Animal Care and Use

Previous research conducted at USAARL required the use of chinchillas for studies involving the effects of noise on the cochlea (a spiral-shaped cavity in the ear). Research activities now conducted at USAARL do not use laboratory animals. If future activities require the use of laboratory animals, research must be conducted in accordance with USAARL Policy No. 40-905, *Animal Care Policy, Care and Use of Laboratory Animals*, and USAARL Policy No. 70-18, *Animal Use Committee* (USAARL, 1997m; USAARL, 1997n).

2.13 Human Health and Safety

2.13.1 Worker Health and Safety

Many of the personnel at USAARL are exposed to different types and levels of noise. The Installation Hearing Conservation Program (USAARL Policy No.40-5) provides civilian and military personnel exposed to noise hazards with noise safety information (USAARL, 1996). Personnel exposed to noise hazards are required to wear hearing protectors (e.g., earplugs, noise muffs, ear canal caps, noise attenuating helmets, or a combination of these) and report for medical and audiometric evaluations (USAARL, 1996).

Investigators involved in the ALSERP at USAARL may encounter bloodborne pathogens during accident site evaluations, ALSE retrieval, and laboratory analysis. To minimize the risk of exposure to bloodborne pathogens, all personnel who are involved in the ALSERP must comply with the bloodborne pathogen program as described in USAARL Policy No. 95-55, Appendix D, *Aviation Life Support Equipment Retrieval Program - Bloodborne Pathogen Program*. The

Bloodborne Pathogen Program identifies work practice controls, personal protective equipment (PPE), housekeeping, post-exposure procedures, signs and labels, and training requirements to prevent exposure to blood and other potentially infectious materials. Bloodborne pathogen surveys must be conducted on accident sites by the president of the CAI board to establish the biohazard nature of the wreckage area. ALSERP field kits are utilized during accident site visits, and must contain the minimum equipment for protection. Equipment contaminated during an investigation is removed and placed in a red biohazard bag. Laboratory work areas, tools, and equipment must be cleaned and disinfected with a bleach solution following an investigation. Spills must be disinfected and contaminated materials placed in biohazard bags for incineration. ALSE and their containers must be placed in red biohazard containers for disposal. In the event of an exposure, the exposed person must undergo a post-exposure examination by a USAARL flight surgeon. Hepatitis B vaccinations are provided at no cost to employees as a preventive measure (USAARL, 1997b).

USAARL employees are required to conduct laboratory operations in accordance with appropriate policies, SOPs, and the Chemical Hygiene Plan (CHP). The CHP details the appropriate use, handling, and disposal of laboratory chemicals including required training and the availability of reference materials.

2.13.2 Accidents and Incidents

The USAARL Safety Manager has overall responsibility for the aviation accident prevention program. The ASO is responsible for detecting and correcting unsafe practices through observation and participation in flight and ground operations. Aviators must report all accidents and incidents in accordance with USAAVNC Regulation 95-2, *Directory of Aviation Training, Facilities and Procedures* (USAARL, 1997e). The ASO must be notified of all Classes A through F mishaps as soon as possible, and is responsible for ensuring that appropriate forms are completed. Accident reports must be reviewed and corrective actions evaluated by the ASO.

Ground accidents are also covered by USAARL Policy No. 385-10. In the event of an accident, division directors and supervisors responsible for the operation, person, or equipment involved must be notified immediately and must ensure that accidents are promptly investigated and reported. The USAARL Safety Manager is responsible for notifying the Chief of the Fort Rucker Safety Office of any accidents resulting in fatality, disability, and/or damage to Army property exceeding $300. A "Report of Serious Accident" is submitted to Headquarters, DA. All recordable accidents, except for Army aviation accidents, are reported on DA Form 285 and maintained by the USAARL Safety Manager. Accident reports must be forwarded to the Chief of the USAAVNC Safety Office in Fort Rucker within 15 days following the accident (USAARL, 1997d).

Accidents and incidents must be investigated in accordance with AR 385-40, *Accident Reporting and Records*. This regulation establishes policies, responsibility, and procedures for initial notification, investigating, reporting, and submitting reports of Army accidents and incidents resulting in damage to Army property, injury (fatal or nonfatal) to on- or off-duty military personnel and on-duty Army civilian personnel, occupational injury or illness to military or civilian personnel, any injury (fatal or nonfatal) or illness to non-Army personnel or any damage to non-Army property as a result of Army operations, Class E aviation incidents, and Foreign Object Damage (FOD) incidents.

3.0 ALTERNATIVES CONSIDERED

3.1 Introduction

The proposed action and subject of this EA is to continue operation of USAARL in its present size and scope (Alternative I, the Preferred Alternative) at Fort Rucker, Alabama. During the preparation of this EA, two alternatives to the proposed action were identified. These alternatives include to relocate the research activities to a site other than USAARL (Alternative II) and cease research activities conducted at USAARL (Alternative III, the No Action Alternative).

3.2 Alternative I – Continue the Operation of USAARL Research Activities

Alternative I involves the continuation of current and currently planned future Army Operational Medicine research activities at USAARL in their present scope and in existing facilities. This alternative is the preferred alternative because the present research efforts at USAARL are considered essential to USAMRMC's mission, and the existing USAARL location offers unique research facilities and direct access to the U.S. Army Aviation Branch Headquarters, U.S. Army Aviation Center and School, U.S. Army Aviation Directorate of Combat Development and all Army Aviation Instructional programs along with other tenant activities such as the U.S. Army Aviation Technical Test Center, the U.S. Army Safety Center, and the U.S. Army School of Aviation Medicine. Alternative I is considered the option which best meets the needs of the national defense.

3.3 Alternative II – Relocate USAARL Research Activities

This alternative entails conducting USAMRMC Army Operational Medicine research activities at a location other than USAARL. This alternative is not preferred because of the unique research facilities, technologies, and Army Aviation Command influence currently available at USAARL. Constructing a new facility or modifying an existing facility for these research activities would not be cost effective and would delay research.

3.4 Alternative III – Cease USAARL Research Activities (No Action Alternative)

Alternative III entails the cessation of the Army Operational Medicine Research activities at USAARL. This alternative is not the preferred alternative because closing USAARL would impair a significant component of USAMRMC's Army Operational Medicine Research Program. Alternative III would impair national defense by reducing research directed towards reducing health hazards.

4.0 AFFECTED ENVIRONMENT

4.1 Introduction

This section of the EA describes aspects of the biophysical and socioeconomic environment potentially impacted by the continuation of USAARL activities at Fort Rucker, Alabama.

4.2 Location and Physical Description

USAARL occupies seven buildings (175,000 square feet) within the Fort Rucker military installation. Fort Rucker covers approximately 64,500 acres in the southeast corner of Alabama, approximately 20 miles northwest of Dothan and 80 miles south of Montgomery. The Installation is approximately 20 minutes from the Florida state line and 45 minutes from the Georgia state line by automobile. Fort Rucker is surrounded by three cities, Enterprise, Daleville, and Ozark which are located west, south, and east of the Installation, respectively. Access to Fort Rucker is through three main gates, the Enterprise Gate, the Daleville Gate, and the Ozark Gate.

4.3 Land Use

Fort Rucker is located in Dale, Coffee, Geneva, and Houston Counties. Major land uses in rural areas include cattle farming, forestry, and cultivation of raw crops, especially peanuts (USACOE, 1996).

4.4 Climate

The climate of Fort Rucker is characterized as humid subtropical with long, hot summers and short, mild winters. The average daytime temperatures range from about 80°F in the summer to 52°F in the winter, with temperatures ranging from 104°F to 6°F. There is generally no frost from mid-March to mid-November. The average annual precipitation for Fort Rucker is 54.5 inches and is fairly evenly distributed throughout the year (USACOE, 1996). Fort Rucker averages one to four hurricanes or tropical storms per year. The hurricane and tropical storm season ranges from May through October, with the peak season occurring in August and September (Fort Rucker, undated).

4.5 Geology

Fort Rucker is located in the red hills portion of the Eastern Gulf Coastal Plain, which covers most of the southern two-thirds of the state. The southeastern section of the Eastern Gulf Coastal Plain is known locally as the Wiregrass section because of a wiry, tough grass that once grew in local pine forests. The area is characterized by deeply dissected sandy hills and ridges with elevations ranging from 500 feet above sea level north of Fort Rucker in the uplands, to 80 feet above sea level south of Fort Rucker near Geneva, Alabama (USACOE, 1996).

4.6 Soils

Soils underlying the Dale County portion of Fort Rucker consist of the Lakeland-Eustis Association and the Shubuta-Cuthbert Association. Forty percent of Dale County is of the Lakeland-Eustis Association, an excessively drained, deep, sandy soil on ridgetops and steep side slopes. These soils are droughty, highly leached, and poorly suited for farming. Shubuta-Cuthbert Association soils cover approximately 25% of the county and consist of moderately well to

somewhat poorly drained soils with clayey subsoils that occur on dissected ridgetops and steep side slopes.

The predominant soil types in developed portions of Fort Rucker are the Red Bay fine sandy loam, very gently sloping phase; the Eustis loamy sand, 0% to 5% slopes; and the Eustis loamy sand, 5 to 12% slopes. The Red Bay fine sandy loam, very gently sloping phase soil is permeable and has a moderate capacity for available moisture. This soil is low in fertility and organic matter content, and is well suited for many crops, especially cotton and peanuts. The Eustis loamy sand soil with 0 to 5% slopes has slow runoff, rapid filtration, and is very permeable to a considerable depth. The soil has a low to very low capacity for available moisture and is very low in fertility and organic matter. The soil is fairly well suited to most of the cultivated crops grown in the county. The Eustis loamy sand soil with 5 to 12% slopes is low in fertility and organic matter, has a low capacity for available water moisture, and is droughty. This soil is less suitable for cultivation than the Eustis loamy sand, 0 to 5% slopes (Soil Conservation Service, 1956). Erosion is a concern in areas surrounding USAARL. There are two areas adjacent to Building 6901 where erosion has occurred. USAARL has two underground storage tanks on Fort Rucker. The Fort Rucker Department of Public Works is currently negotiating contracts for removing the existing underground tanks and replacing them with aboveground storage tanks (Licina, 1998c).

4.7 Water Resources

4.7.1 Surface Water

The Fort Rucker region is drained by several small streams which empty into Blacks Mill Creek to the east and Steep Head Creek to the west and south. Blacks Mill Creek joins Steep Head Creek which flows into Claybank Creek approximately 3 kilometers below the Lake Tholocco Dam. Lake Tholocco was a 600 acre recreational lake located on Fort Rucker and part of a 51,400 acre watershed. In 1990, the dam broke and the lake is now greatly reduced in size. Claybank Creek flows into the Choctawhatchee River. The Choctawhatchee River drains 3,100 square miles of southeastern Alabama and empties into Choctawhatchee Bay in the Gulf of Mexico.

4.7.2 Groundwater

USAARL obtains its drinking water from the Fort Rucker water distribution system which is supplied by seven groundwater wells. Groundwater obtained from the wells is high in quality and requires only chlorination and fluoridation. Occasionally, water in USAARL facilities is discolored by iron and other precipitates. This discoloration results from generalized decreased usage within the water distribution system and inadequate flushing of the pipes supplying water to USAARL. According to the 1995 Environmental Compliance Assessment Report (ECAR), the water distribution system was improperly sized in some areas as a result of changes in population and building use, principally the closing of a WWII era convalescence facility located south of USAARL. The water distribution system serving USAARL has been flushed periodically to maintain water quality; however, problems of low chlorine residuals and consumer complaints are unresolved. Fort Rucker water sampling and analyses meet all State and Federal requirements (U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM), 1995).

4.8 Plant and Animal Ecology

Approximately 80% (51,088 acres) of Fort Rucker is forested. USAARL facilities area located in an open area. Within a few hundred feet south of these facilities is a forested area which has overgrown the site of a former WWII convalescence complex.

Four forest types are common to Fort Rucker. Pine forests are common on upland areas and forests composed of a mixture of pine-hardwood are found on the lower slopes. Bottom lands are dominated by hardwoods and cypress-tupelo swamps which are associated with larger streams. Fort Rucker's Natural Resource Division is responsible for managing forests except for those located in restricted areas (approximately 15,100 acres). Complete forest management is not possible. These forests are maintained similarly to commercial forests (USACOE, 1996).

The forests and associated pasture, agricultural lands, wetlands, and streams found on Fort Rucker provide a diverse habitat for a large variety of animal species. The forests also support recreational activities such as nature walks, bird watching, and hunting. Common game species in the area include white-tail deer, turkey, red and grey fox, rabbits, and squirrels. Sightings of over 110 bird species have been recorded at Fort Rucker. Game birds include turkey, dove, quail, and some ducks (USACOE, 1996).

4.9 Endangered and Threatened Species

Two endangered species, the bald eagle (*Haliaeetus leucocephalus)* and the American peregrine falcon (*Falco perigrinus anatum*) may migrate through the Fort Rucker region, although neither species utilizes the area for feeding or nesting. The endangered ivory-billed woodpecker (*Campephilus principalis*), the Florida panther (*Felis concolor coryi*), and Bachman's warbler (*Vermivora bachmanii*) have not inhabited the region for several years. The red-cockaded woodpecker (*Picoides borealis*), an endangered species, inhabits the southeastern portion of Alabama including Dale County. This species is not known to inhabit the Installation because of the lack of aged pine forests which normally provide its required habitat. Three state sensitive species are found within the boundaries of the Installation: Choctawhatchee darter (*Etheostoma davisoni*); green-fly orchid (*Epidendrum conopseum*); and bluethreads (*Burmannia capitata*). Two species listed in the Alabama Non-game Species Regulation (ALABAMA 220-2-.92) are found on the Installation. These species are the dusky gopher frog (*Rana capito sevosa*) and the southeastern pocket gopher (*Geomys pinetis*) (Lewis, 1997). The gopher tortoise (*Gopherus polyphemus*) is common in a number of areas on the Installation. This species is protected by Fort Rucker's Natural Resource Division, although it is not a listed species in eastern Alabama. The American alligator (*Alligator mississippiensis*), which is classified as "threatened because of similarity of appearance" for law enforcement purposes, is also known to inhabit Fort Rucker (USACOE, 1996).

4.10 Wetlands

The nearest wetland to USAARL is a small semi-permanently flooded wetland approximately one-half mile from the facility (USGS, 1998).

4.11 Air Quality

The Air Division ADEM has jurisdictional responsibility for the state's air resources through implementation of state and federal laws regulating air quality to protect human health, as well as

plant and animal resources. Alabama maintains 73 air quality monitors to measure concentrations of criteria air pollutants in the ambient air at 56 sites. Under the CAA, the U.S. Environmental Protection Agency (USEPA) adopted the National Ambient Air Quality Standards (NAAQS) to control the criteria air pollutants (sulfur dioxide (SO_2), carbon monoxide (CO), nitrogen oxides (NOx), volatile organic compounds (VOCs), lead (Pb), and particulate matter). Data collected from the monitors are entered into the USEPA Aerometric Information Retrieval System (AIRS), the national USEPA database for monitoring and air emission compliance (ADEM, 1996). Areas not meeting the NAAQS are designated as "non-attainment" areas.

The air quality at Fort Rucker and the surrounding area is good (USACOE, 1996). Coffee County and Dale County are classified as attainment areas for all NAAQS by the ADEM. There were no violations recorded in the state for Pb, SO_2, NOx, CO, and particulate matter during 1996 (ADEM, 1996).

4.12 Historical and Cultural Resources

There are two potentially significant archeological sites on Fort Rucker that are eligible for the National Register of Historic Places (USACOE, 1994). However, these sites are geographically removed from USAARL facilities (Maher, 1998).

4.13 Socioeconomic Environment

USAARL employs 104 full-time and 20 part-time employees (Licina, 1998a). Fort Rucker has a total population (residents and employees) of approximately 17,000 which includes 6,302 military personnel, 6,982 civilians, and 3,704 military family members (USACOE, 1996). According to 1990 U.S. Census Bureau data, the number of individuals residing at Fort Rucker was 7,593. In 1990, 32% of Fort Rucker's population were under the age of 17, 68% were between the ages of 17 and 65, and less than 1% were over the age of 65. In 1990, 97% of individuals over the age of 25 had at least a high school education. Residents at Fort Rucker have some college education and 26% had a bachelor's degree or higher in 1990. In 1990, 1,553 housing units on the Installation were approximately 97% renter occupied. Median household income for 1990 was $24,872 and per capita income was $9,434 (EPIC Relocation Services, LLC, 1997; University of Virginia Library Social Sciences Data Center, 1997).

According to 1990 data, civilian employment by industry at Fort Rucker was as follows: wholesale and retail trade (26%), public administration (15%), manufacturing (15%), other (11%), health services (10%), education (7%), personal services (6%), transportation (4%), finance, insurance, and real estate (3%), and agriculture, forestry, and fisheries (1%) (EPIC Relocation Services, LLC, 1997; University of Virginia Library Social Sciences Data Center, 1997). Routine operations at Fort Rucker contribute significantly to the local economy with total expenditures of approximately $909 million in fiscal year 1992 (USACOE, 1996).

4.14 Environmental Justice

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority and Low Income Populations*, requires federal agencies preparing NEPA documents to address any significant adverse impacts of federal projects on minority or low income populations. According to 1990 census data, 75% of Fort Rucker's population is Caucasian, 19% African American, 3% Asian or Pacific Islander, and less than 1% American Indian, Eskimo, or Aleut (University of Virginia Library Social Sciences Data Center, 1997). The U.S. Census defines the poverty level as

the income level, based on family size, age of householder, and the number of children under 18 years of age, that is considered too low to meet essential living requirements without regard to the local cost of living. To be considered a "poverty area" as defined by the Census Bureau, at least 20% of the area's population must be living below the poverty level. In 1990, 9% of all persons within Fort Rucker were living below the poverty level (University of Virginia Library Social Sciences Data Center, 1997). As such, Fort Rucker is not considered a low-income community under Executive Order 12898.

4.15 Noise

There are no records of complaints regarding noise originating from USAARL activities (Licina, 1998c).

4.16 Odors

There are no records of complaints regarding odors originating from USAARL (Licina, 1998c).

4.17 Transportation

The Installation can be accessed through three gates, the Ozark Gate from the east, the Enterprise Gate from the west, and the Daleville Gate from the south. The main entrance to Fort Rucker is located in Daleville. U.S. Highway 231 runs northwest to southeast across Dale County and passes through Ozark. U.S. Highway 84 crosses the southwestern corner of the county.

Fort Rucker is serviced by two bus lines. Greyhound stops in Ozark, and Trailways maintains a bus stop and ticket office in Building 104 (Dothan Progress, 1997). The Atlantic Coast Line Railroad runs through the county, passing through Fort Rucker and Daleville before entering Coffee County. Commercial airline service is available at the Dothan/Houston County airport.

4.18 Public Opinion

There are no records of negative public opinion regarding USAARL activities (Licina, 1998b).

5.0 ENVIRONMENTAL CONSEQUENCES

5.1 Introduction

In this section, the potential environmental and human health consequences of the continued operation of USAARL at its current location and in its present size and scope will be discussed. This section will identify and analyze potential cause and effect relationships which may exist between the proposed action and potential impacts, if any. Such an analysis entails detailing the potential impacts associated with the proposed action at USAARL that may not necessarily occur, but which are reasonably foreseeable. This analysis determines if continuing USAARL research activities have the potential for significant environmental impacts.

The term "consequence" refers to the results of an event or events without consideration of probability. Where possible and appropriate, potential events will be characterized both in terms of their potential consequence and the probability that they will occur. Consequences of the proposed action on the public, the workers, and the environment will be considered. Direct, indirect, and cumulative impacts will also be considered.

5.2 Environmental Consequences of Routine Operations at USAARL

5.2.1 Land Use

The continued operation of current and future planned research activities at USAARL will not adversely impact land use in Fort Rucker, Alabama. There are no projected impacts to land use associated with implementation of the proposed action because current research activities are conducted in existing facilities, no construction or renovation is proposed, and land use is not currently being adversely affected or altered. Buildings 6901 through 6906 and Building 8925, in which USAARL activities are conducted, are compatible with adjacent land uses on the Fort Rucker Installation.

5.2.2 Climate

The air quality in the vicinity of USAARL and Fort Rucker is good; it is not anticipated that the climate of Fort Rucker will be adversely impacted by implementing the proposed action (see Section 5.2.8).

5.2.3 Geology

It is unlikely that the continued operation of USAARL will negatively impact geological resources at the Fort Rucker Installation because construction or renovations are not planned.

5.2.4 Soils

Impacts to soils resulting from the implementation of the proposed action (Alternative I) will likely be minor to negligible. Existing erosion adjacent to Building 6901 is minor and small in area. USAARL facilities are situated in conformance with local topography and there is no evidence to suggest that USAARL activities have contributed to excessive erosion. It is unlikely that continuing USAISR activities will impact soils in the future. Negligible impacts to soils, topography, and erosion may result from USAARL's contribution to local landfills through the disposal of waste materials. USAARL's contributions are negligible in comparison to the total solid waste stream of Fort Rucker and surrounding areas.

5.2.5 Water Resources

Implementing the proposed action (Alternative I) is unlikely to diminish water resources at Fort Rucker or surrounding areas. Quantitatively, USAARL wastewater contributions are a small component of total wastewater discharges resulting from all Fort Rucker activities. The volume of wastewater generated at USAARL is not expected to significantly change from the conduct of current or currently planned activities. In accordance with Federal and Alabama regulations, wastewater generated by USAARL activities undergoes treatment by Fort Rucker Main Sewage Treatment Plant. Hazardous chemical waste, regulated medical wastes, and radiologic wastes must be segregated at their site of generation as required by Federal, state, and USAARL regulations which further mitigates degradation of surface water resources. Potential adverse impacts to surface water quality resulting from the accidental discharge of restricted wastes are extremely unlikely. Facility design features (berming, approved cabinets and containers) and adherence to regulations greatly reduce the probability of such an event occurring.

5.2.6 Plant and Animal Ecology

It is unlikely that the continued operation of USAARL will impact the plant and animal ecology of Fort Rucker. USAARL is an existing facility and no renovation or construction activities are planned. Adherence to regulations governing disposal of the wastes generated by research activities at USAARL will ensure that the potential adverse impacts to wildlife are minimized. Wildlife and/or endangered species are not used in the conduct of USAARL research projects. The potential for the adverse impacts to aquatic life in the water bodies receiving discharges from USAARL activities through the Fort Rucker wastewater treatment facility is negligible and mitigated by adherence to NPDES permitting rules which include monthly monitoring.

5.2.7 Wetlands

No impacts to wetlands are expected to result from the continuation of USAARL activities at Fort Rucker. The nearest wetland to the USAARL facility is located over 1.5 mile away. It is highly unlikely that current or currently planned USAARL activities would impact this wetland.

5.2.8 Air Quality

Continued operation of USAARL in its present scope is not anticipated to impact the ambient air quality or climate in the Fort Rucker region. Regulated medical wastes and potentially infectious wastes generated by USAARL are no longer incinerated in the on-site incinerator (see Section 4.11). Another potential source of air emissions from USAARL activities is vehicular traffic associated with commuting of the workforce. Vehicle emissions from the commuting activities of the workforce at USAARL are not anticipated to change from current levels. The USAARL employs 104 full-time and 20 part-time workers (Licina, 1998a). The number of vehicles associated with USAARL operation is very small compared to the total number of vehicles associated with all of Fort Rucker activities. Vehicular traffic resulting from the continuation of USAARL activities represents a negligible contribution to air pollution at Fort Rucker.

5.2.9 Historical and Cultural Resources

No impacts to significant historical or cultural resources in Fort Rucker are expected to result from implementing the proposed action. USAARL is not located near any properties listed on or eligible for the National Register of Historic Places (Maher, 1998).

5.2.10 Energy Resources

Implementation of the proposed action is not expected to result in adverse impacts to energy resources. The current energy usage of USAARL activities is small in comparison to the energy requirements of all Fort Rucker activities. The energy resource requirements of USAARL activities are not anticipated to change significantly from the conduct of current or currently planned activities.

5.2.11 Socioeconomic Environment

The socioeconomic impacts resulting continued operations at USAARL will likely be minor but positive impacts to the local economy. Although continued operation of USAARL is unlikely to create new jobs in the Fort Rucker region, the proposed action will maintain employment levels and support existing government operations. The USAARL currently employs 104 full-time and 20 part-time employees (Licina, 1998a). Local aesthetics will not be adversely impacted by continued operation of USAARL because the facility conforms to existing land use patterns.

5.2.12 Environmental Justice

Continued operation of the research activities at USAARL is not expected to result in adverse impacts to minority or low income populations in Fort Rucker. According to 1990 statistics, 9% of all persons within Fort Rucker were living below the poverty level (University of Virginia Library Social Sciences Data Center), and Fort Rucker is not considered a "poverty area" as defined by the Census Bureau. The 1990 census data also indicates that 75% of Fort Rucker's population is Caucasian. Because USAARL research activities are not expected to result in significant adverse impacts to air quality, noise levels, visual resources, transportation systems, odors, utilities, energy supplies, historical and cultural resources, or waste generation, implementation of the proposed action is not anticipated to have any disproportionately high adverse human health or other environmental impacts on low income or minority populations at Fort Rucker.

5.2.13 Noise

It is not anticipated that continued operation of USAARL research activities will generate a significant amount of noise on the Installation. (Need reference from Installation PAO).

5.2.14 Odors

Implementation of the proposed action is not anticipated to generate significant odors on the Installation.

5.2.15 Transportation

The impacts to transportation resources in the area of Fort Rucker associated with the conduct of routine operations at USAARL are negligible. Because USAARL activities are conducted in existing facilities and no additional employees are required, traffic patterns in the vicinity of Fort Rucker will not be adversely impacted by implementation of the proposed action.

5.2.16 Public Opinion

Similar research activities have been conducted at USAARL since it was established in 1962, and it is unlikely that there will be public opposition to its continued operation. A potential concern regarding the proposed action might be the use of human volunteers in research activities. A strict

quality assurance program is implemented for all USAARL research protocols involving the use of human volunteers to ensure compliance with regulatory guidelines and proper protection of human volunteers (see Section 5.2.17.2).

5.2.17 Human Health and Safety

5.2.17.1 Worker Health and Safety

Routine operations at USAARL pose a negligible risk to the health and safety of the workforce. Risks to the workforce at USAARL are minimized through the use of safety equipment, procedures, and training. SOPs incorporating health and safety regulations are required for research operations. Since 1989, there have been only two instances in which employee injuries resulted in time missed from work. These were not serious incidents in nature and the injuries were minor and temporary.

5.2.17.2 Human Volunteer Health and Safety

Risks posed to the health and safety of human volunteers used in USAARL research projects are negligible. All research protocols involving the use of human subjects must be conducted in accordance with USAMRMC Regulation Number 70-25 (see Section 2-11) which requires that all protocols involving the use of human volunteers must undergo a scientific review process and be presented before the HUC prior to initiation. The HUC is responsible for determining and documenting whether the subjects will be placed at risk. Protocols determined to involve more than a minimal risk to human volunteers must be reviewed and approved by the HURRAO, the HSRRB, and TSG prior to initiation (USAMRMC, 1990). USAARL's QA Program monitors and evaluates the quality of research and development and assures compliance with regulations. A MM is responsible for ensuring the health and safety of the subjects (USAARL, 1997a). The MM is a qualified physician who monitors human subjects during research activities and provides medical care to subjects for conditions which may arise while research is being conducted. Stringent policies and procedures are in place at USAARL to protect the health and welfare of human subjects. There have been no instances of significant injury to human subjects at USAARL. Continued operation of the research activities conducted at USAARL is not anticipated to have a significant adverse impact on the health and safety of human volunteers.

5.3 Cumulative Impacts

USAARL is located in existing facilities and the ongoing operations have not resulted in any significant identifiable impacts. No negative cumulative impacts to human health or the environment are anticipated from routine operations at USAARL. Activities qualitatively and quantitatively similar to existing operations have been performed at USAARL since 1961 without evidence of adverse cumulative impacts to the environment. It is unlikely that cumulative impacts will result from continued operations at USAARL. Negligible impacts may result from operation of the medical waste incinerator and USAARL's minor contribution to the Fort Rucker waste stream. Routine operations at USAARL have negligible impacts on the health and safety of the public and the USAARL workforce. Continued operation of USAARL results in a minor positive impact to the local economy.

5.4 Comparison of the Proposed Action with the Alternatives

5.4.1 Alternative I – Continue the Operation of USAARL Research Activities

Alternative I includes the continued conduct of current and currently planned future research activities at USAARL in their present scope and in existing facilities. This alternative is considered the preferred alternative because it fully utilizes state-of-the-art equipment and technology and experienced personnel. Continued operation of USAARL in its present scope involves the continuation of negligible adverse impacts such as contributions to the waste stream and to local air quality. Potential impacts to worker health and safety are negligible and are mitigated through the use of strict safety requirements. Potential adverse impacts to the health of human volunteers are minimized by adherence to regulations and standards governing their selection, use, and medical monitoring. This alternative is the preferred alternative because it also includes continued support of USAMRMC's Army Operational Medicine Research Program, contributions to the scientific community, and best meets the needs of the national defense.

5.4.2 Alternative II – Relocate USAARL Research Activities

Alternative II entails relocating the current and currently planned future research activities performed at USAARL. The potential environmental and human health impacts associated with USAARL research activities are primarily site independent. With appropriate operational and safety controls in place, the activity can be conducted at almost any location without significant adverse impacts to the environment. Relocating USAARL research activities would require similar controls and compliance with applicable regulations. Construction of a new facility or renovation of an existing facility to support the mission of USAARL has the potential for negative impacts to the environment as a result of construction efforts and might delay execution of USAARL's mission. It would likely be very expensive to reconstruct or relocate the state-of-the-art equipment and facilities located at USAARL. This alternative is not preferred because moving USAARL research activities to another location would have similar impacts to human health and the environment after completion of construction or renovation activities. Further, this alternative is not considered the preferred alternative because it is not envisioned to have any foreseeable benefit over the preferred alternative.

5.4.3 Alternative III – Cease USAARL Research Activities (No Action Alternative)

USAARL is a functioning organization, therefore, the no action alternative means that the activities presently assigned by USAMRMC to USAARL would cease. This alternative would entail discontinuing a significant portion of the Army Operational Medicine Research Program. Implementing this alternative would eliminate the negligible to minor impacts (e.g., insignificant contributions to air, land, water, and waste streams) associated with the preferred alternative, but the needs of national defense would not be best served by this alternative.

6.0 CONCLUSIONS

The principal conclusions of this EA are: 1) risks to the environment and human health and safety associated with the continued operation of USAARL in its present scope and location (Alternative I) are extremely small; 2) the research activities conducted at USAARL will result in important benefits to the United States military personnel; and 3) implementation of the proposed action (Alternative I) will not result in significant adverse environmental or human health impacts. Relocation of USAARL research activities to another location (Alternative II) will not significantly alter the environmental impacts associated with this project and will cause a significant delay in meeting the needs of national defense. Further, transferring USAARL research activities to another location would not utilize the state-of-the-art facilities and technologies already in place. Cessation of USAARL research activities (Alternative III) will eliminate the potential environmental and human health impacts associated with the proposed action, however, this alternative would impair the national defense posture by reducing the protection provided to U.S. military personnel on the battlefield.

The continued operation of USAARL research activities at Fort Rucker is likely to be conducted without significant adverse environmental impact. The most severe potential effects associated with the proposed action are anticipated to be minor, and to date, all observed effects at this site have been insignificant. Potential risks to the USAARL workforce, the local community, and the environment will continue to be mitigated by the application of required work practice and engineering controls that direct the safe handling, use, and disposal of hazardous materials. Further, implementation of the proposed action (Alternative I) will result in significant benefits to the national defense posture.

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10.0 ACRONYMS AND ABBREVIATIONS

^{125}I	Iodine 125
µCi	microcurie
ADEM	Alabama Department of Environmental Management
AI	Associate Investigator
AIRS	Aerometric Information Retrieval System
ALSE	Aviation Life Support Equipment
ALSERP	Aviation Life Support Equipment Retrieval Program
ALSO	Aviation Life Support Officer
ALSS	Aviation Life Support System
ANVIS	Aviator's Night Vision Imaging System
AR	Army Regulation
ASO	Aviation Safety Officer
ATP	Aircrew Training Program
BOD_5	biological oxygen demand - 5 days
CAA	Clean Air Act
CAI	Centralized Accident Investigation
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CHP	Chemical Hygiene Plan
CO	carbon monoxide
DA	Department of the Army
EA	Environmental Assessment
ECAR	Environmental Compliance Assessment Report
ECS	Environmental Control System
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FOD	foreign object damage
HSRRB	Human Subjects Research Review Board
HUC	Human Use Committee

HURRAO	Human Use Review and Regulatory Affairs Office
ID	identification
MARS	Multi-Axis Ride System
MEDCOM	U.S. Army Medical Command
MM	Medical Monitor
MSDS	Material Safety Data Sheet
NAAQS	National Ambient Air Quality Standards
NCO	Noncommissioned Officer
NEPA	National Environmental Policy Act
NOx	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
NVD	night vision devices
NVG	night vision goggles
OTSG	Office of The Surgeon General
Pb	lead
PI	Principal Investigator
PPE	personal protective equipment
ppm	parts per million
QA	Quality Assurance
RCC	Radiation Control Committee
RCRA	Resource Conservation and Recovery Act
RPO	Radiation Protection Officer
RT	Research Technician
SLCT	Small Letter Contrast Test
SO_2	sulfur dioxide
SOP	Standard Operating Procedure
TC	Training Circular
TSCA	Toxic Substance Control Act
TSG	The Surgeon General
USAARL	U.S. Army Aeromedical Research Laboratory

USAAVNC	U.S. Army Aviation Center
USACHPPM	U.S. Army Center for Health Promotion and Preventive Medicine
USACOE	U.S. Army Corps of Engineers
USAMRMC	U.S. Army Medical Research and Materiel Command
USARIEM	U.S. Army Research Institute of Environmental Medicine
USEPA	U.S. Environmental Protection Agency
VOCs	volatile organic compounds
WRAIR	Walter Reed Army Institute of Research